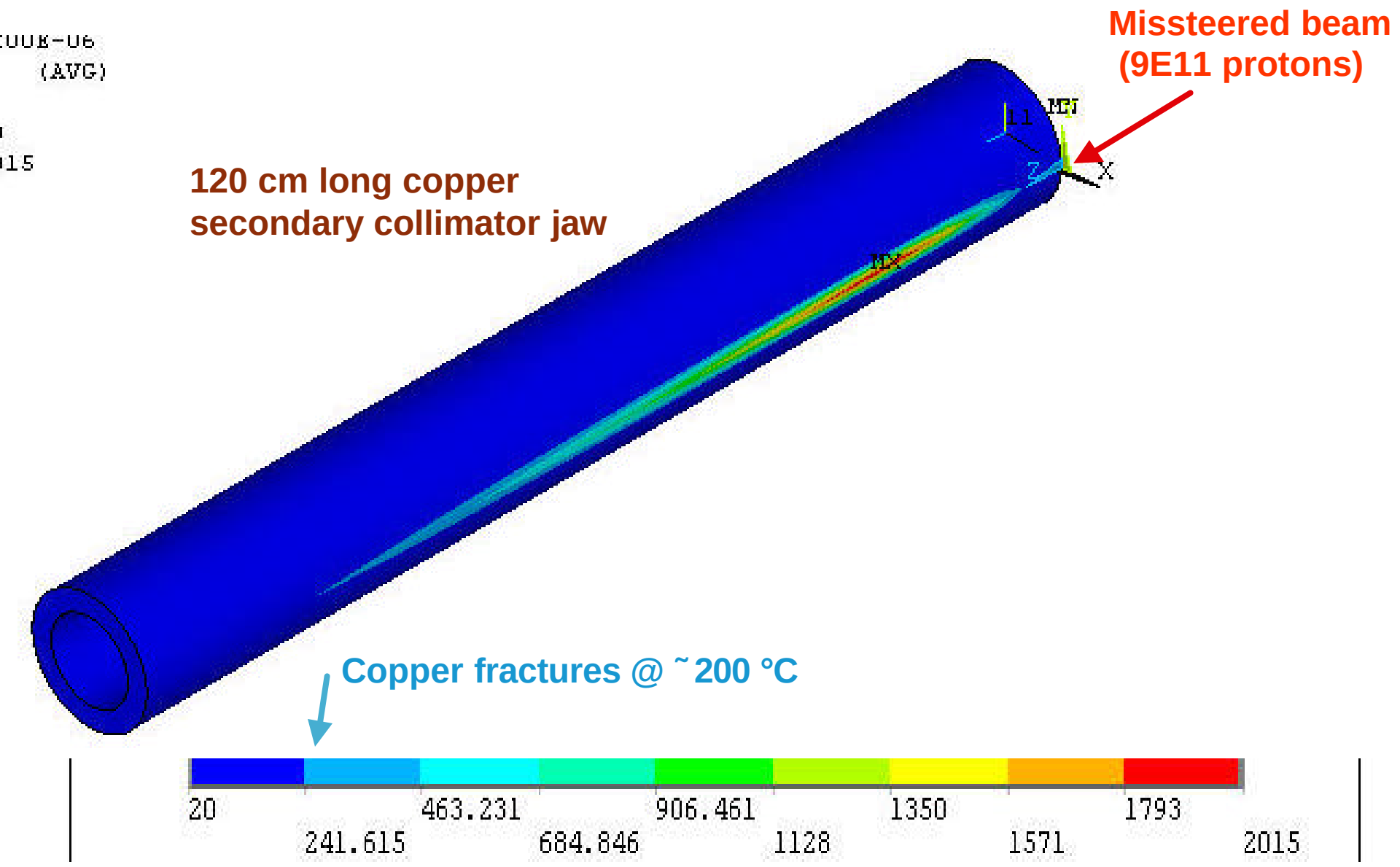
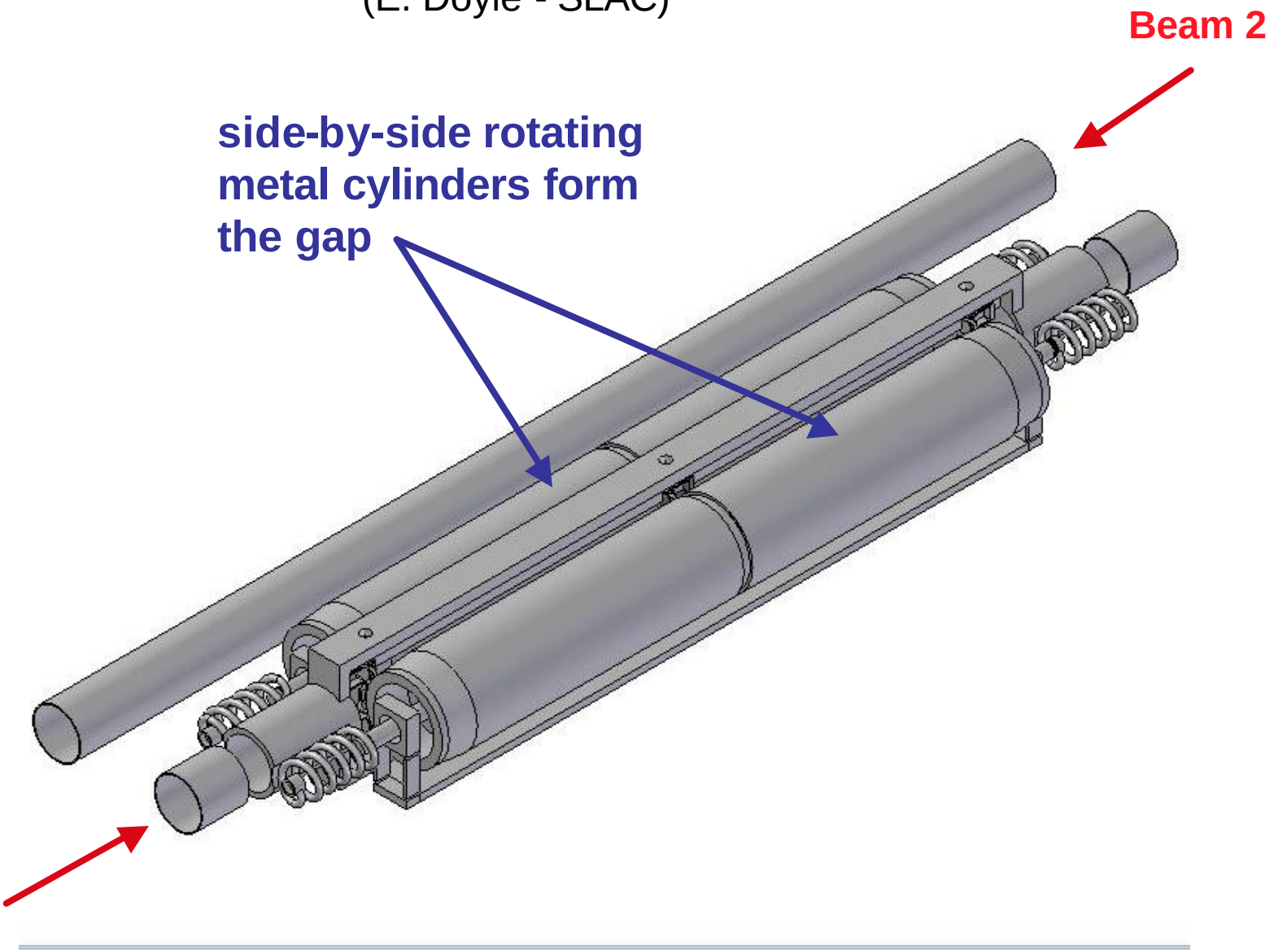
Problem: **A kicker failure can deposit 9 x 10^{11} protons on any metallic secondary collimator - causing it to melt within a substantial volume.**



LHC Renewable Collimator Concept

(E. Doyle - SLAC)

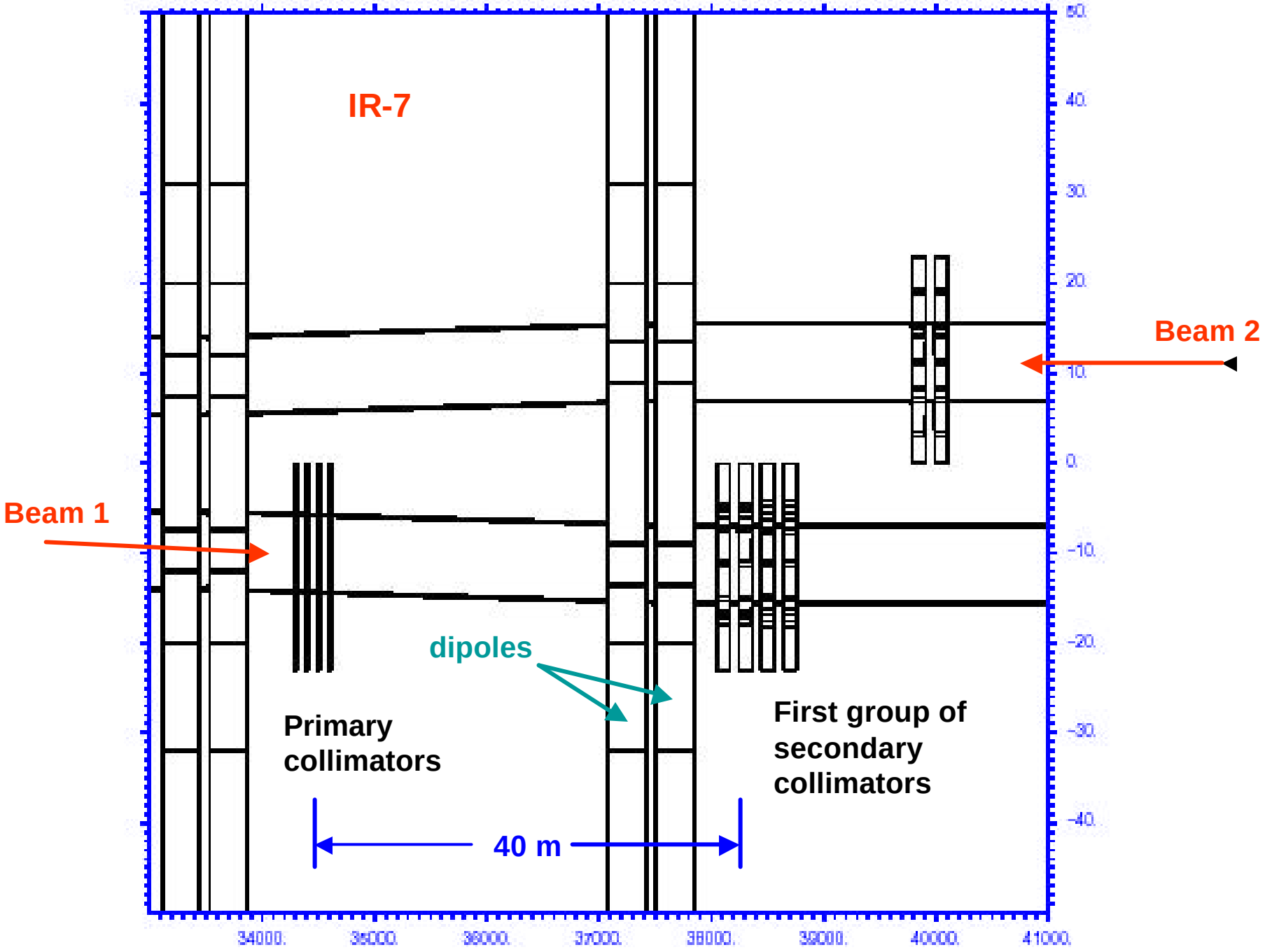


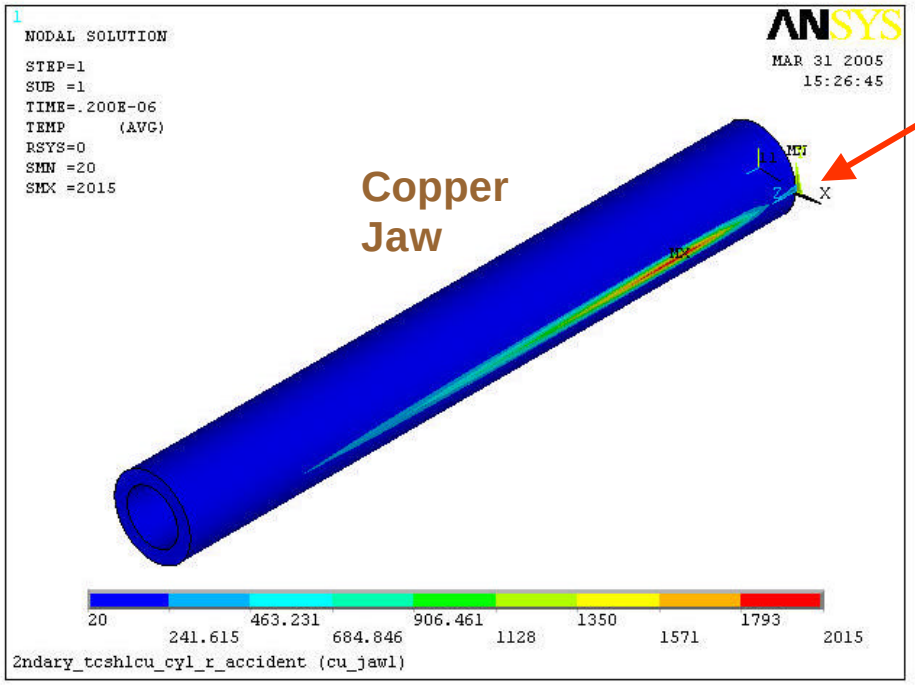
L. Keller
LARP, Apr. 2005

Recent Energy Deposition Simulations

1. **Look at accident effects on various secondary collimators.**

2. **Run the FLUKA model with the LHC V6_5_lowb lattice, collimator data, and ray files of inelastic interactions in the primary collimators.**

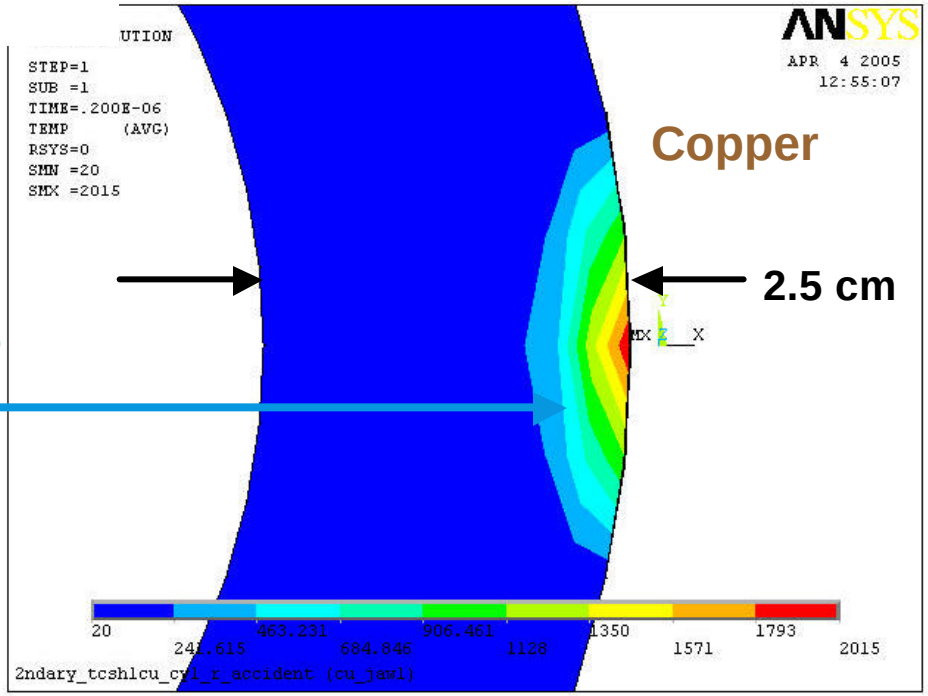

IR-7
Beam 1
Beam 2
dipoles
Primary
collimators
First group of
secondary
collimators
40 m
50.
40.
30.
20.
10.
0.
-10.
-20.
-30.
-40.
34000.
35000.
36000.
37000.
38000.
39000.
40000.
41000.



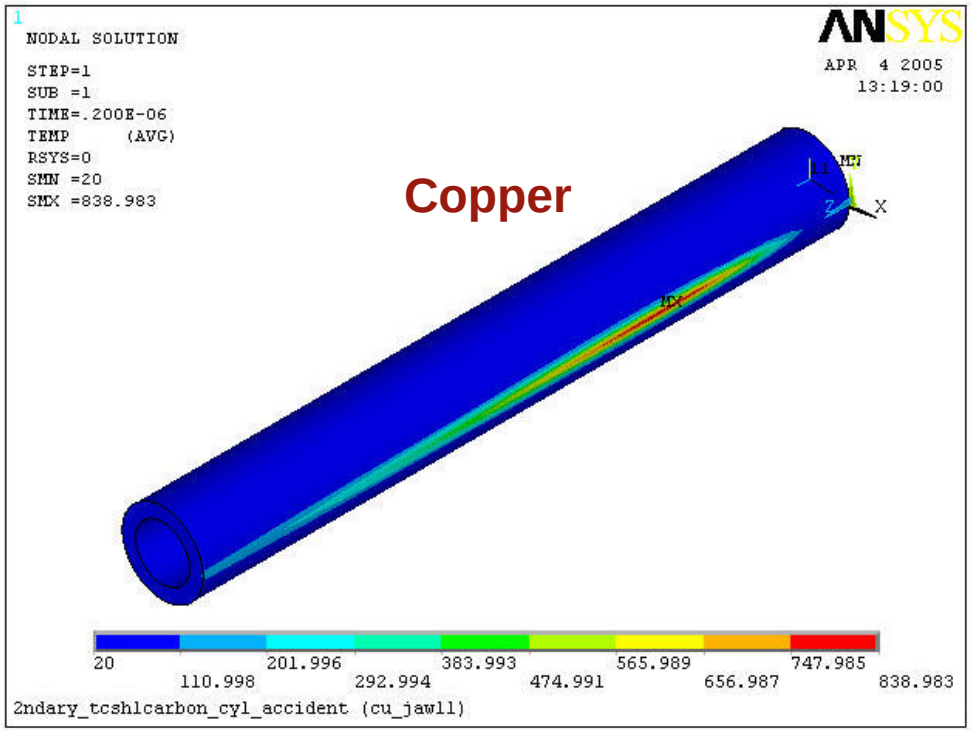
Missteered beam (9E11 protons) on secondary Jaw

What is the damage area in a missteering accident?

Cross section at shower max.

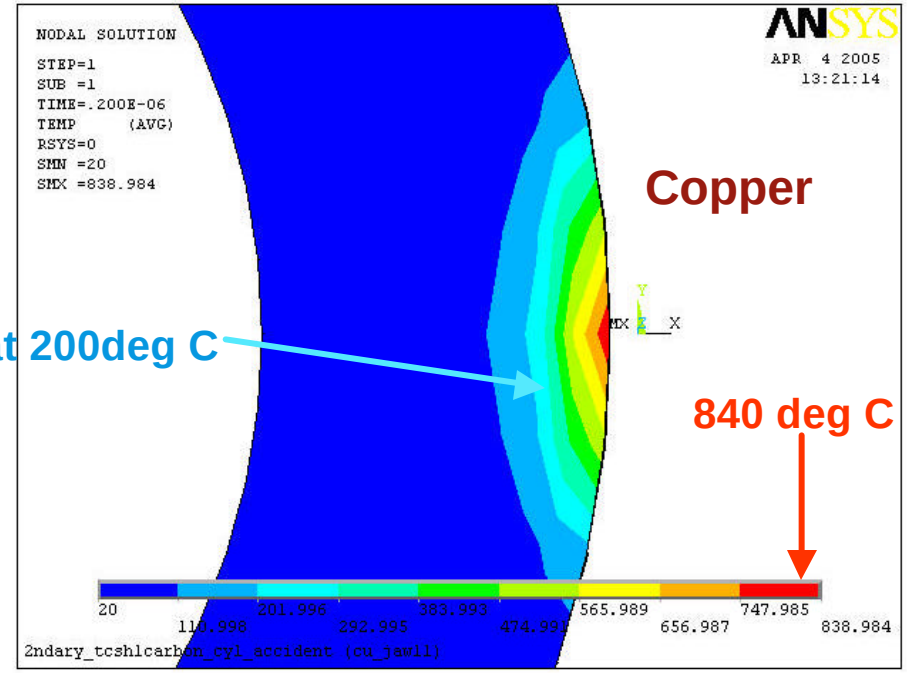


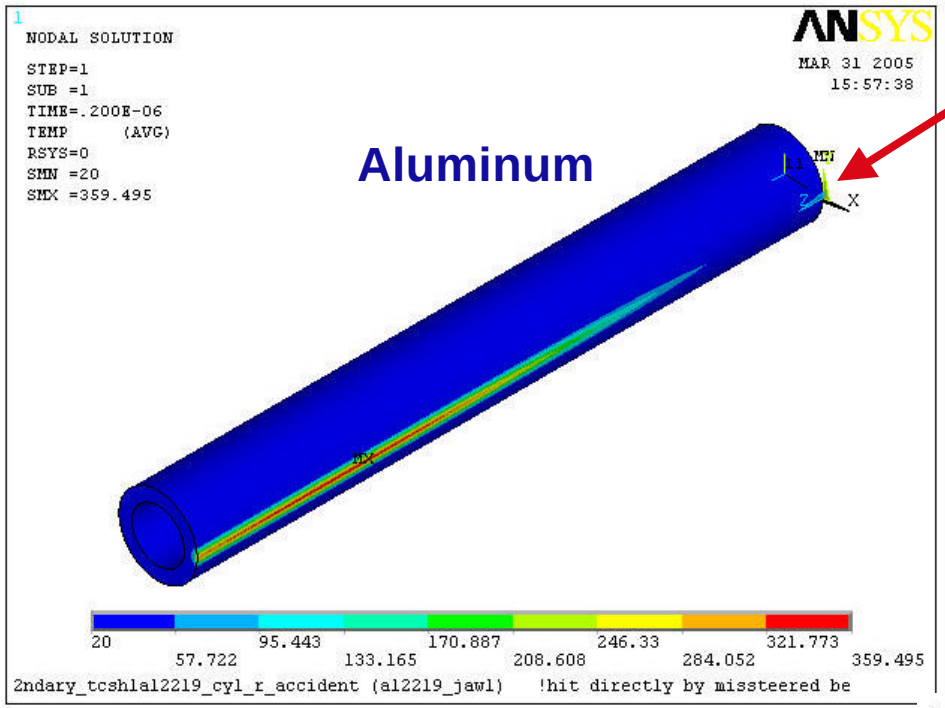
Fracture temp. of copper is about 200 deg C



Accident Case – jaw adjacent to the one being directly hit, ~ 4 mm gap.

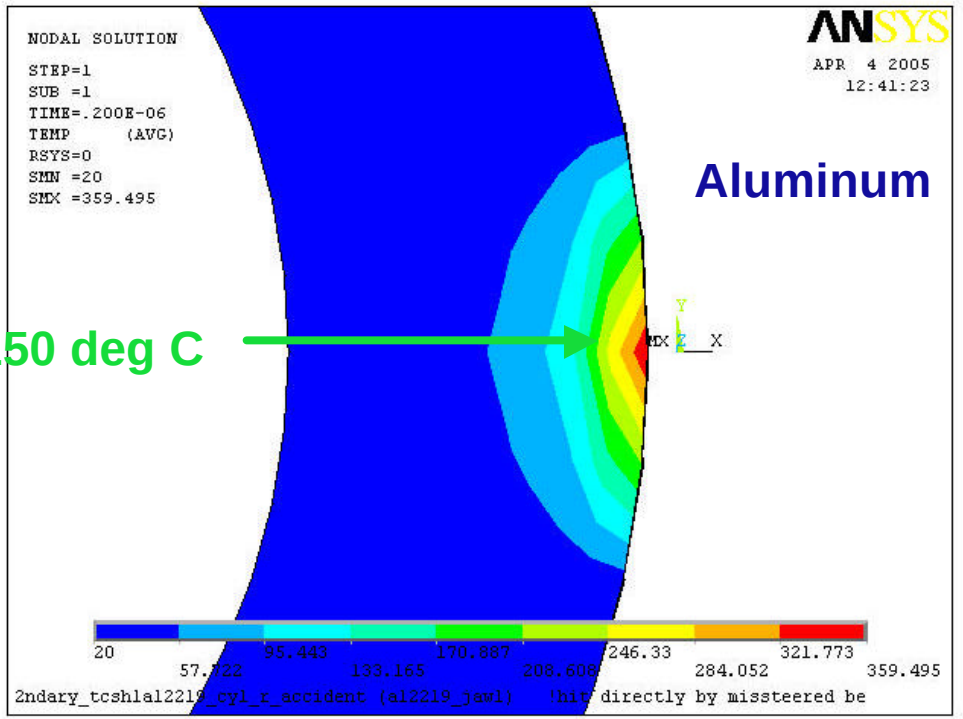
This jaw may be damaged too.



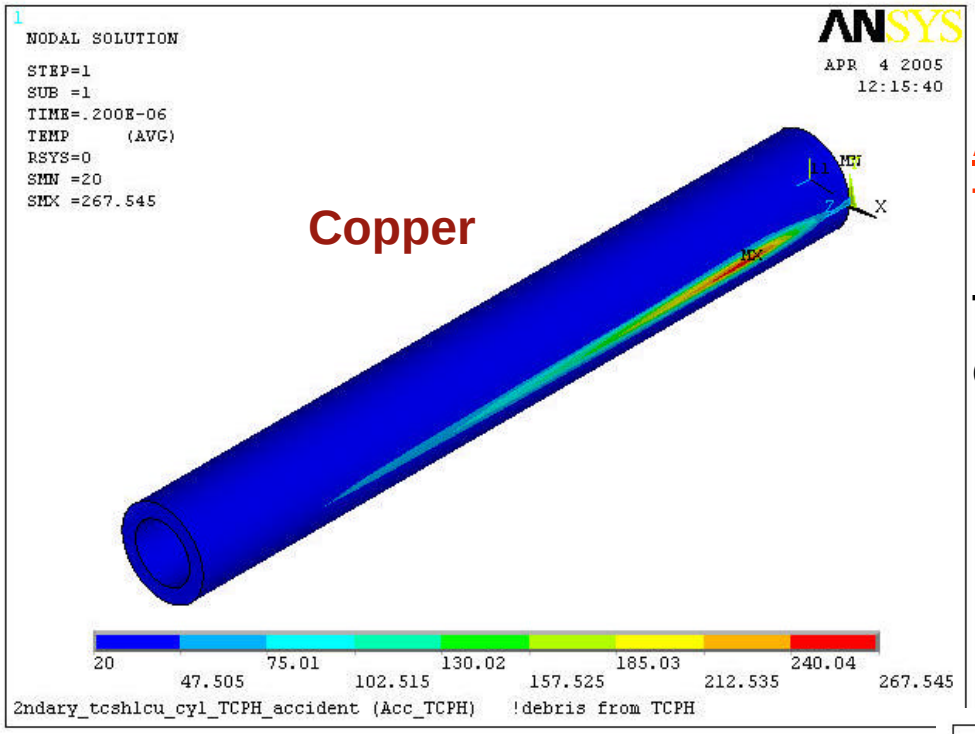


Accidental direct hit

What about damage to ALUMINUM secondaries ?

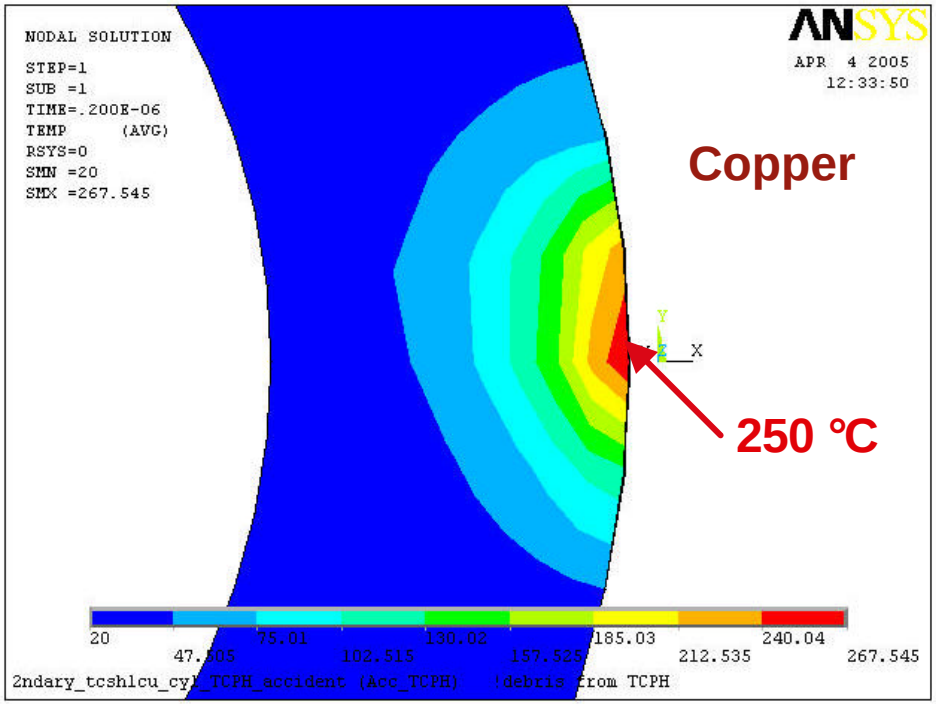


Fracture 150 deg C



Another accident Case – Beam hits the horizontal primary collimator

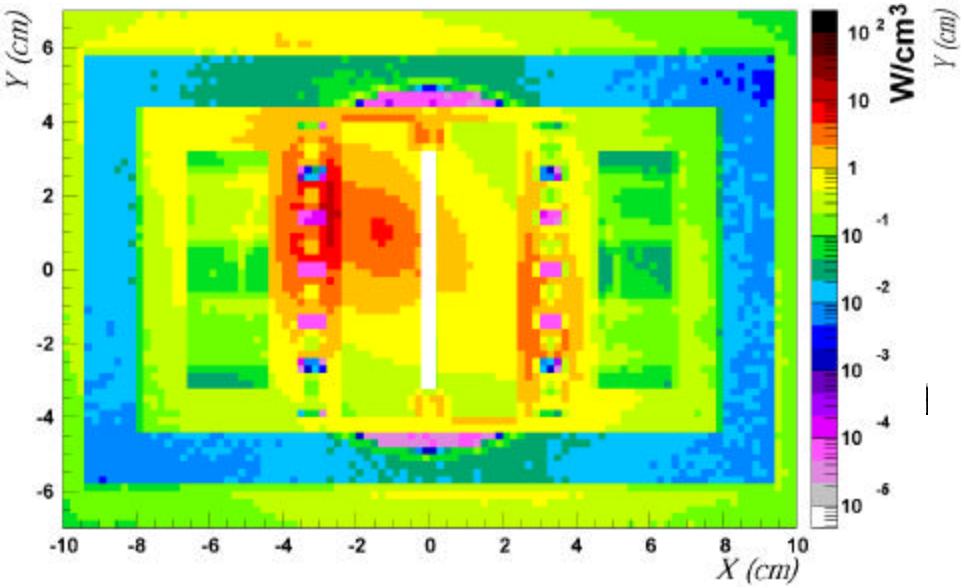
The first jaw in the downbeam secondary collimator (40m away) may be damaged.

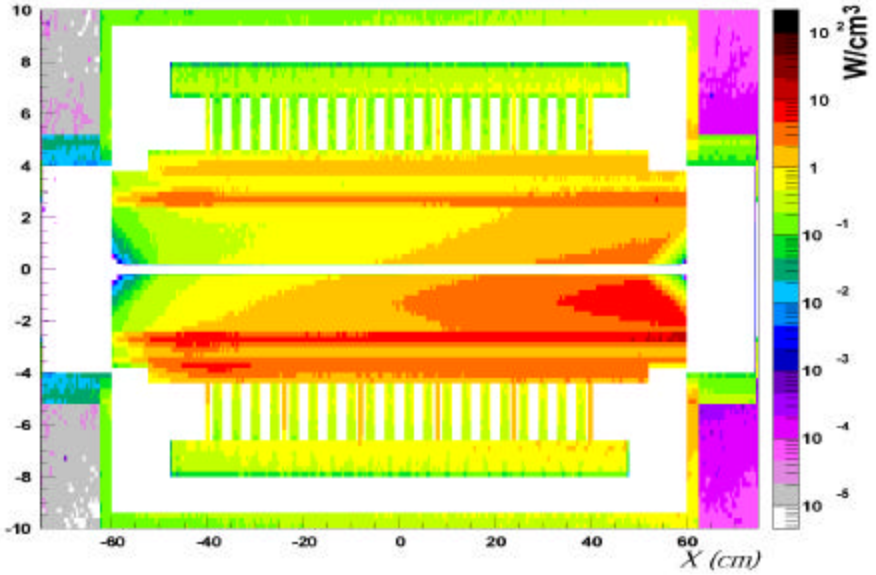


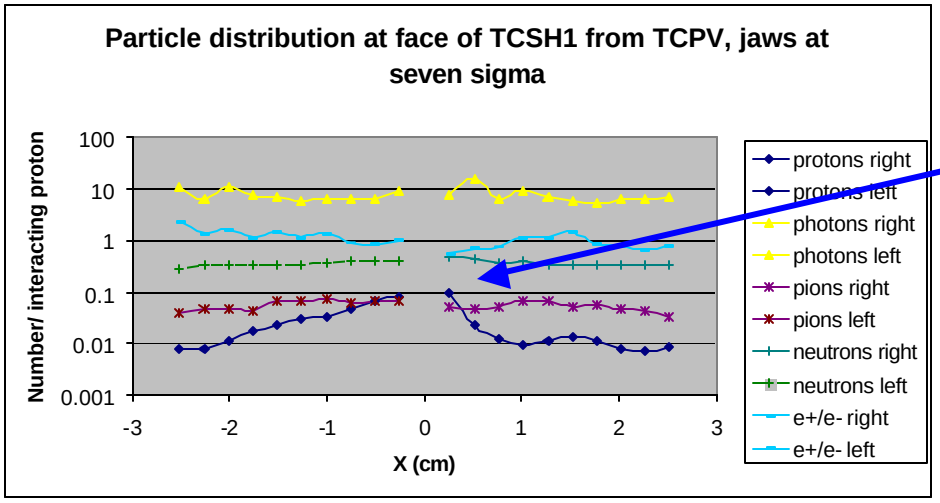
CERN Collimation Group Picture of Energy Deposition in the First Secondary Collimator (note hot spot near middle of left jaw)

The SLAC model shows the maximum energy deposition on the inner edge of the jaw

- **why different?**
- **what is the physics?**

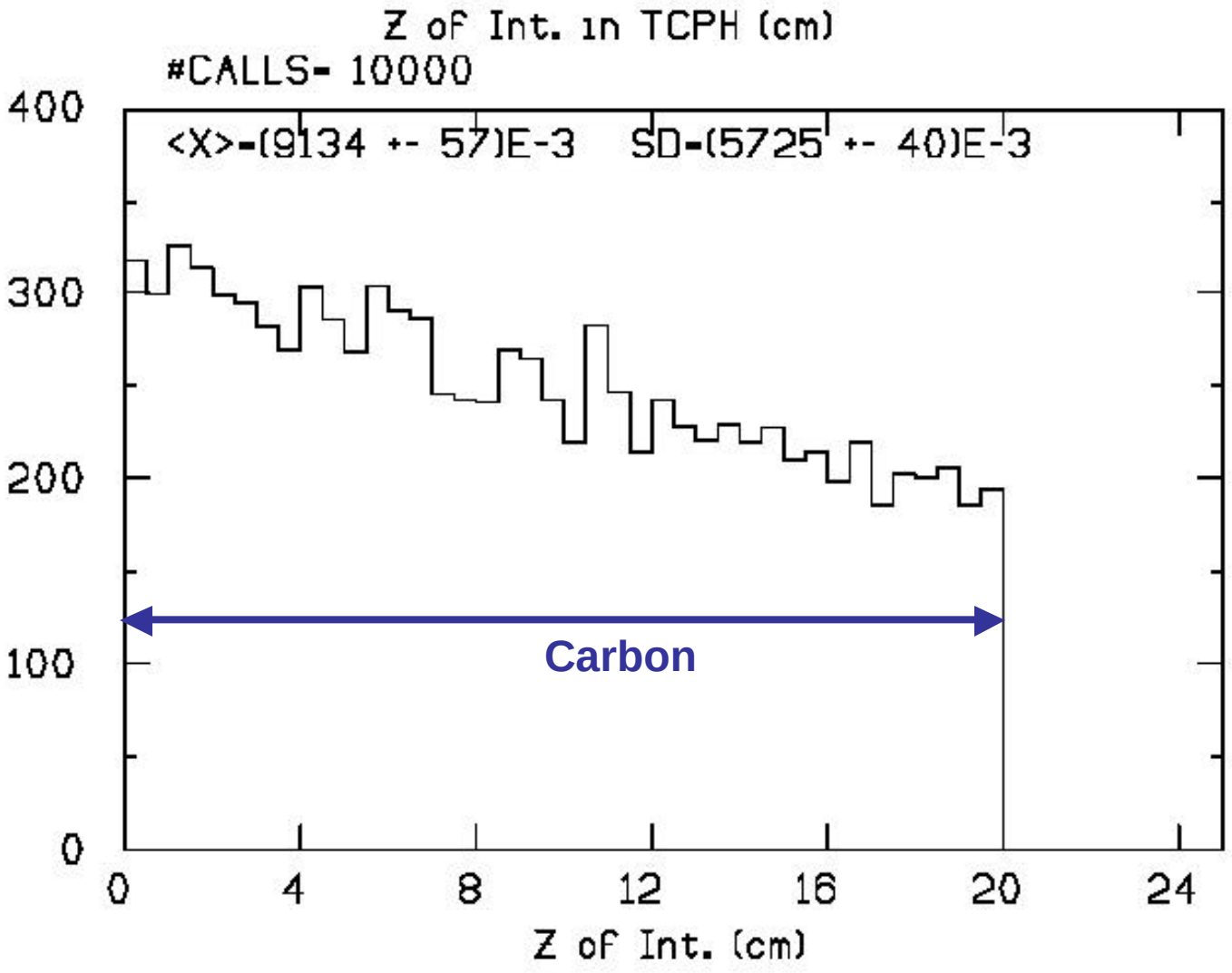




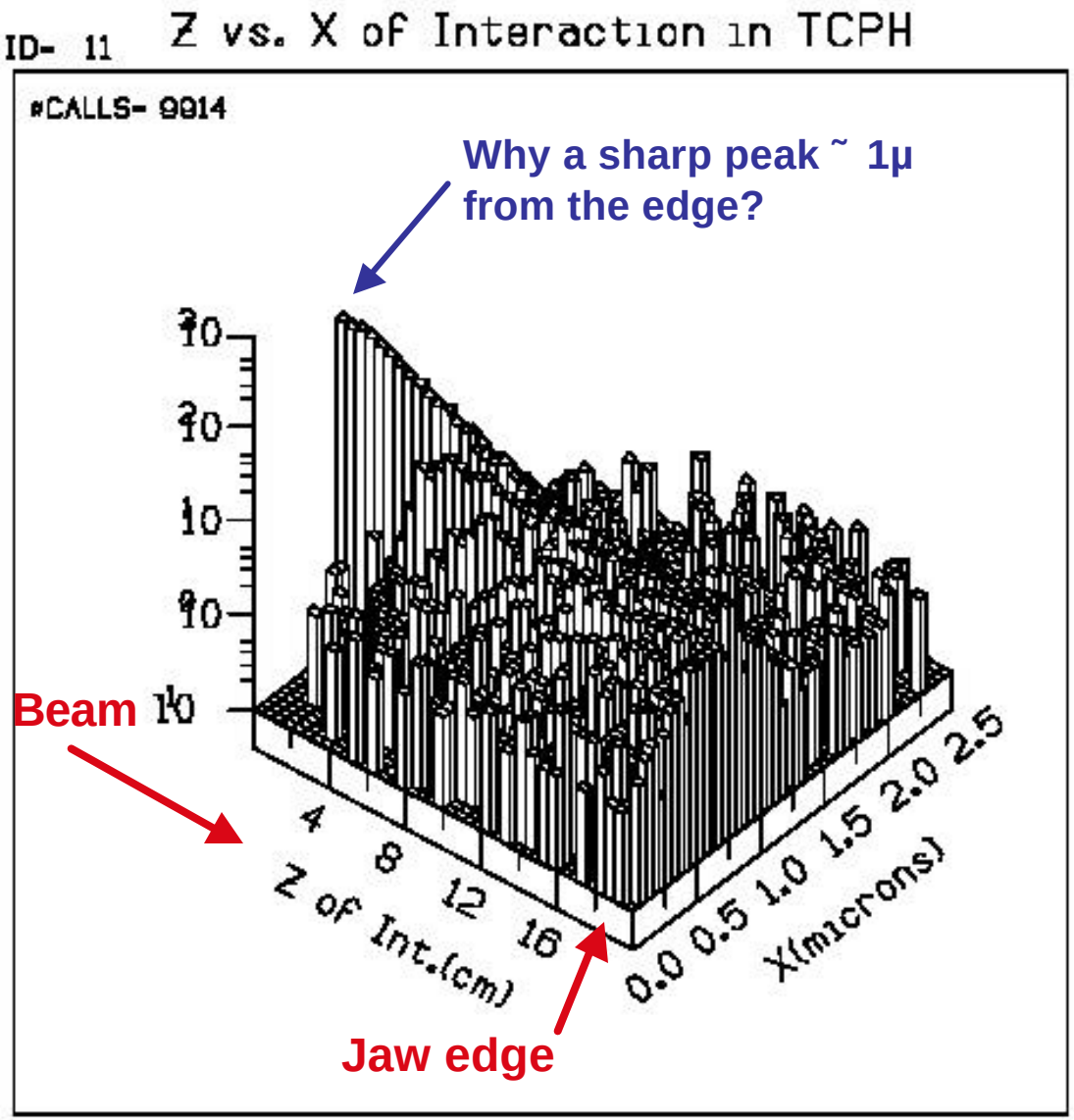


See no proton spike 1 cm from edge of jaw

Axial Distribution of Halo Interactions in the Second Primary Collimator (TCPH)



Axial Position of Halo Interaction Point vs. Distance from Primary Collimator Edge



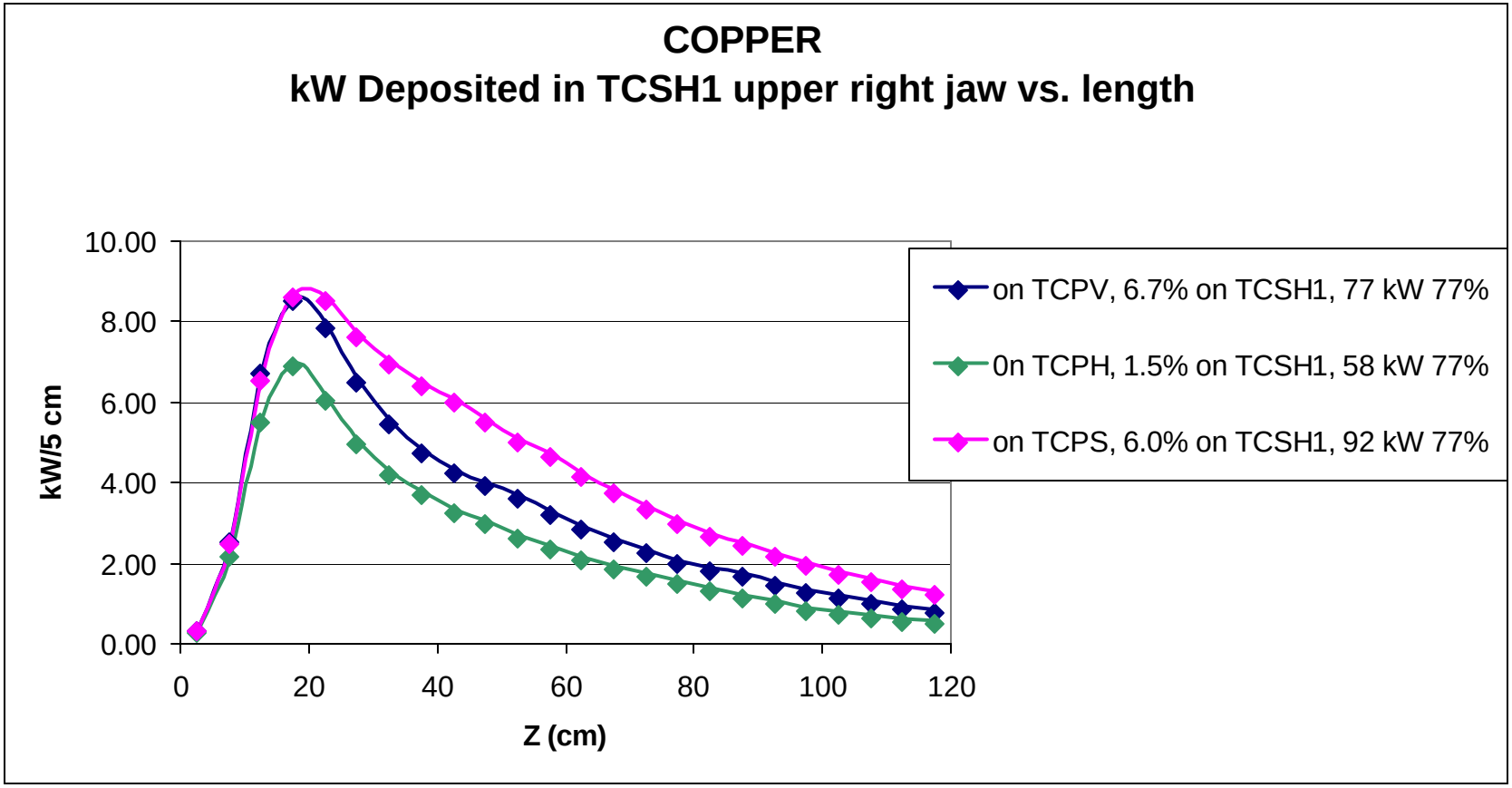
Power Deposition on First Secondary Collimator in 12 Min. Lifetime
(kW per jaw)

Primary Collimator (source)	TCSM.B6.L7 Jaws at 7 sigma		TCSM.B6.L7 Jaws at 10 sigma	
	Copper	Al_2219	Copper	Al_2219
TCP.D6.L7 (TCPV)	73	26	51	19
TCP.C6.L7 (TCPH)	61	22	49	19
TCP.B6.L7 (TCPS)	92	28	56	20

Notes:

1. Collimator data, ray files, and loss maps from LHC Collimator web page, Feb. 2005.
2. Must add contribution from direct hits on secondary jaws.

Power Deposition on First Secondary Collimator vs. Length for Three Primary Collimator Sources



Notes:

1. **12 minute beam lifetime**

2. **Primary jaws at 6 sigma, secondary jaws at 7 sigma**

For Discussion:

What can be done to reduce the power deposited in the first two secondary collimators?

1. **Add a >10 sig absorber in front of dipoles MDW**
2. **Withdraw the jaws to somewhere between 7 and 10 sigma to spread the load to downstream collimators**
3. **------**
4. **------**